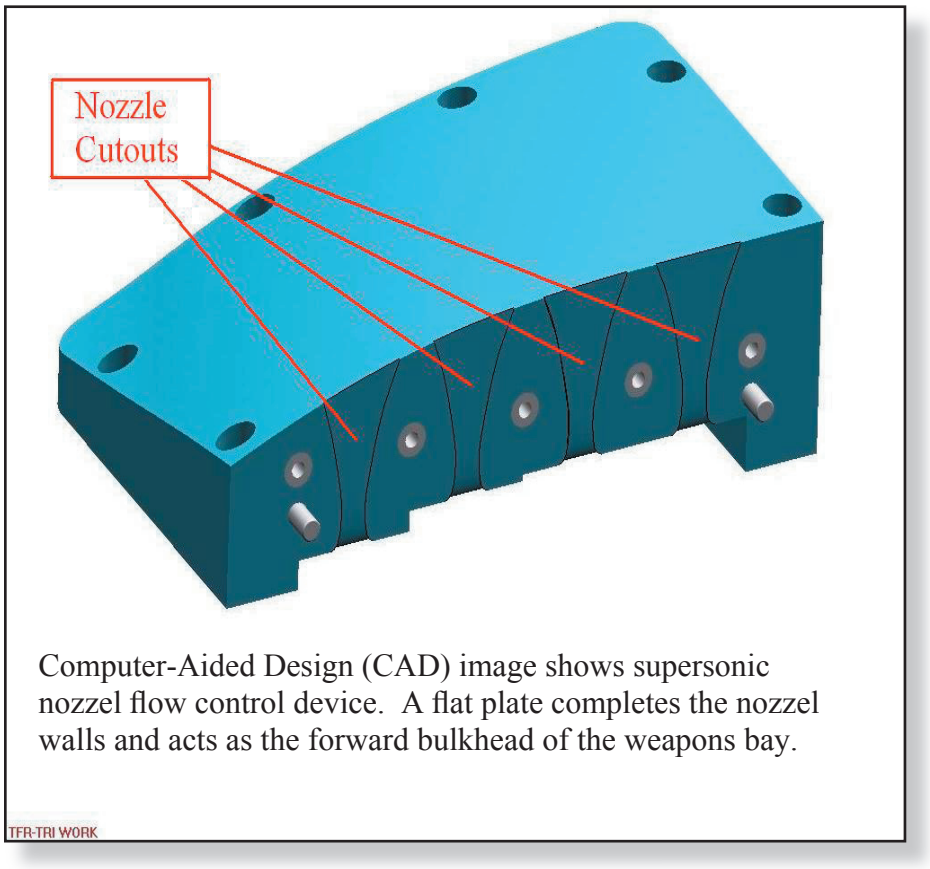
Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

AFRL PERFORMS SUCCESSFUL J-UCAS ACOUSTIC SUPPRESSION WIND TUNNEL TESTS



Computer-Aided Design (CAD) image shows supersonic nozzel flow control device. A flat plate completes the nozzel walls and acts as the forward bulkhead of the weapons bay.

AFRL scientists teamed with Boeing Aerospace to develop supersonic flow control actuators as a replacement for the spoilers traditionally used to reduce weapons bay acoustics. The actuators, powered by engine bleed air, effectively reduce acoustics over a wide range of flight conditions, aid in safe weapons separation, and do not protrude from the aircraft.

Air Force Research Laboratory
Wright-Patterson AFB OH

Accomplishment

AFRL scientists developed flow control actuators that operate on available engine bleed air and expel a supersonic jet of air that counters the acoustic resonance created by opening weapons bay doors during flight. The actuators can be used for both suppressing acoustic resonance and enhancing weapons release.

In a series of wind tunnel tests conducted at Arnold Engineering and Development Center, Arnold Air Force Base (Tennessee), AFRL scientists coordinated with the Joint Unmanned Combat Air Systems (J-UCAS) System Program Office to determine the effectiveness of these actuators. Using the J-UCAS weapons integration model, AFRL scientists proved that the actuators effectively reduced the acoustic resonance created by opening weapons bay doors. In addition, they determined that the actuators improved the position and attitude of a model MK-83 Joint Direct Attack Munition upon its release from the model's weapons bay.

Background

Opening weapons bay doors during flight creates a shear layer—an area where airflow transitions sharply from the high-speed airflow outside the weapons bay to slower-speed airflow within the bay. The result is flow instability; pockets of circularly rotating air, called vortices, hit the weapons bay walls and generate an acoustic wave. This wave flows back up the airstream and causes acoustic resonance, producing strong vibrations that may damage the aircraft and its systems.

Flow control devices are designed to counter this effect. The J-UCAS program is a joint Defense Advanced Research Projects Agency/Air Force/Navy effort to develop an unmanned air vehicle to carry out missions in areas such as surveillance, precision strike, and enemy air defense suppression.

Air Vehicles
Emerging Technologies

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (05-VA-11)